Original Article

Exploring osteoporosis sufferers knowledge on sedentary behaviour in the management of their disease

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Abstract

Objectives: 1) To develop an understanding of the thoughts and opinions of older women diagnosed with osteoporosis regarding sedentary behaviour and 2) Investigate strategies used to reduce sedentary behaviour for future intervention development. **Methods**: Eleven older women with osteoporosis (mean age=68.2y±6.6(SD)) participated in semi-structured interviews (March-May 2020). They were recruited from the Royal Osteoporosis Society (Scottish) support group networks and the Strathclyde Age-Friendly-Academy. Telephone interviews were recorded, transcribed verbatim and thematically analysed using Braun & Clarke (2006). **Results**: Three main themes emerged: 'Older Women's Knowledge', 'Motivators to reduce Sedentary Behaviour' and 'Older Adult's and Technology'. Participants reported an increase/maintenance of physical activity levels after osteoporosis diagnosis, had a good understanding and awareness of sedentary behaviour and how it affects health holistically. Participants identified motivators to interrupt sedentary behaviour (e.g. family/friends) and facilitators of sedentary behaviour (e.g. Television). Technology appeared to be used widely among participants to track movement patterns (e.g. Fitbit) but access and usability were identified as potential barriers when using technology to reduce sedentary behaviour among older adults. **Conclusion**: Knowledge does not appear to be a factor that needs addressing in relation to sedentary behavior in older women diagnosed with osteoporosis. Identified motivators and barriers could increase awareness of sedentary behaviour among older adults.

Keywords: Knowledge, Older Adults, Osteoporosis, Sedentary Behaviour, Views

Introduction

Sedentary behaviour (SB) is defined as 'any waking behaviour characterized by an energy expenditure ≤1.5 Metabolic Equivalent of Tasks (METs) while in a sitting, reclining or lying position'[1]. Prolonged SB has been identified as a risk factor for cardiovascular disease (CVD), diabetes, musculoskeletal dysfunction, cancer and all-cause mortality, which is generally independent of the amount of physical activity (PA) carried out[2-5]. Older adults (OA) are the most sedentary and inactive subgroup of the population, self-reporting SB between 5.3 to 9.4 hr/day[3,6]. High levels of SB accompanied with an ageing population places further burden on individuals and healthcare systems. For example, Scotland alone is predicted to have a 26% increase in pension receivers by the year 2035 and it is estimated that SB related illnesses cost the UK's NHS £1.6 billion annually[7,8].

The loss of bone mass accompanies the ageing process and could be further accelerated by prolonged periods of SB however, there is a lack of literature to suggest SB is an independent risk factor for osteoporosis (OP)[9,10]. Weight-bearing/loading PA has long been established as a form of preventing and managing bone loss[11,12]. Daily functional exercise, such as walking, has been associated with a 30%

lower risk of falling and fractures in older Caucasian women (>65 years)[13]. Extreme forms of unloading (e.g. prolonged bed rest) result in diminished stimulus for bone formation and increased rate of bone breakdown, leading to a rapid bone mass loss[14]. Although people rarely endure prolonged bed rest, prolonged uninterrupted SB is ubiquitous in everyday life and could be viewed as a mild form of bed rest potentially leading to comparable bone mass reductions[10].

Previously, public health interventions have successfully helped break up SB in healthy OA populations but these interventions are limited, with short follow-ups and further high quality research is required in this field[15,16]. Similar interventions have also shown potential signs of reducing SB in OA and improving health outcomes in a number of diseases and conditions such as CVD, obesity and cognitive impairment but with very limited information regarding OP[17-19]. The involvement of the end-users (e.g. target population) in the decision making and planning process, to facilitate behaviour change and develop effective interventions through co-creation, is recommended[20].

Therefore, the purpose of this study was to explore the views and knowledge of older women with OP regarding the role of SB in the development and progression of their condition. In addition, the study aimed to explore the views on possible ways in which older women would be willing to reduce their sedentary time and/or break up long bouts of SB.

Methodology

Ethical approval was gained through the School of Psychological Sciences and Health Ethics Committee at The University of Strathclyde prior to commencing the study (53/28/01/2020). Participants gave informed consent before data collection.

Participants

Participants were recruited through the Strathclyde Age-Friendly-Academy (AFA) membership and the Scottish section of Royal Osteoporosis Society (ROS) patient support groups based in Glasgow and Edinburgh. Inclusion criteria were: (a) aged 50 years or older, (b) clinically diagnosed with OP, (c) mobile/community dwelling, d) English speaking. Participants were given a participant number and a pseudonym for anonymity in further analysis.

Study design

Semi-structured telephone interviews were adopted from the originally planned face to face focus groups to accommodate for COVID-19 social distancing guidelines. The phone interviews took place over a two-month period (March – May 2020), while the COVID-19 lockdown occurred. An interview topic guide was followed which contained broad open questions in line with the study's aims. The topic guide focused on three areas: a) knowledge of SB in the context of their diagnosis, b) views on SB and c) intervention ideas to

Demographic characteristic	
Participants (n)	11
Age at interview (years) Mean (SD)	68.2 (6.6)
Age at diagnosis (years) Mean (SD)	59.6 (12.1)
Duration diagnosed (years) Mean (SD)	9.3 (9.6)
Height (m) Mean (SD)	1.66 (0.06)
Weight (kg) Mean (SD)	62.9 (9)
BMI[1] (kg/m^2) Mean (SD)	23 (4)
Length of Interview (hr: min) Mean (SD)	1:01 (0:14)
SIMD[2] (%) Categories 1 to 5	[1] 0, [2] 0, [3] 9, [4] 0, [5] 91

[1]BMI- Body Mass Index. [2]SIMD- Scottish Index of Multiple Deprivation.

Table 1. Demographics (N=12).

break up prolonged SB or reduce total time spent sedentary. Each interview entailed a brief discussion about COVID-19 self-isolation/quarantine and its' impact on daily life which may have altered participants views and experiences with SB and PA. All interviews were led by the same researcher (CG). Transcribed (verbatim) interviews were uploaded onto NVivo 12 Pro software to be analysed.

Prior to the main interview, participants completed basic demographic information (e.g. self-reported height and weight to calculate Body Mass Index (BMI)), medication/supplement use for OP, co-morbidities and any history of falls which might have led to fractures. Socio-Economic Status (SES) was assessed using the Scottish Index of Multiple Deprivation (SIMD), where a postcode is used to determine whether a person lives in an area that is deemed most deprived (SIMD 1) or least deprived (SIMD 5)[21].

The data was thematically analysed using Braun & Clarke's six steps to thematic analysis: familiarisation, initial coding, initial development of themes, review of identified themes, naming and finalisation of themes and writing up the report[22]. A combined inductive (bottom up) and deductive (top down) approach was taken to ensure each of the study's two aims were addressed and to allow a balanced suspicious/empathetic approach in the analysis[23]. One researcher transcribed and analysed all transcripts (CG). Around fifty initial codes emerged from the data which were then sorted into potential themes and subthemes with repetitive reviews of the data set as a whole. Reviewing the coded extracts and drawing a thematic map refined the codes which resulted in the final three main themes and nine subthemes (Table 2). Double checking and confirmation of coding was carried out by another member of the research team (FM) in a random selection of identified themes (16.7%) to ensure agreement with the analysis[24]. Other co-authors who work closely with OP with OA discussed and agreed the themes.

Theme	Subtheme
Older Women's Knowledge	Physical Activity
	Sedentary Behaviour (SB)
	Impact of SB
Motivators to reduce or sustain SB	Motivators to interrupt SB
	Encouraged SB
	Age related deterioration
Older people and Technology	Reminders to interrupt SB
	Use of Technology
	Barriers to technology

Table 2. Summary of Themes and Subthemes.

Results

Eleven female participants aged between fifty-six and eighty-two years were interviewed over the phone. Interviews took between 46 minutes to 93 minutes (Table 1).

The age of the participants at OP diagnosis ranged from 40 years to 79 years old while the duration since they were diagnosed ranged from two months to thirty-one years (Table 1). The average BMI of the participants 23±4 kg/m^2 (Table 1) was within the healthy range for BMI[25].

Knowledge, Views and Experience

Three main themes and nine sub-themes were extracted from the analysis (Table 2).

Older Women's Knowledge

Physical Activity

The participants in the study understood the role exercise plays in managing their disease, e.g. weight-bearing exercise is essential for loading the bone to create a stimulus for bone formation. All participants appeared to represent a good level of knowledge of their own disease.

"jump 50 times a day on a hard surface and that would help the bones to strengthen... I do try to do something that is pressurising the hip and the leg bones you know I do try to jump on the hard surface and hope that it is doing me some good" (Orla)

Generally, participants stated that they either became more active or maintained their activity levels after they were diagnosed with OP.

"I would say I was always fairly active but probably do a little bit more [since the diagnosis]" (Mary)

They had little knowledge of the recommended PA guidelines for health, about the amount of moderate to vigorous activity they should aim for, the importance of strength and balance or the emphasis on reducing sitting time. However, they did highlight the importance of '*walking*' as a mode of cardiovascular exercise. Some participants had a general awareness of guidelines for aerobic exercise, others recognised that it is important to '*get your heart rate up*'. One participant was able to recite the total time of '*150 minutes per week*' that should be spent in aerobic activity, however, there was some confusion towards the frequency and no mention of intensity.

"sort of yes is it to do 30 mins exercise at least 3 times a week" (Sarah)

All participants engaged in PA however, there was a wide variety of modes within the sample population. The types of exercise reported could be divided into categories such as:
a) structured exercise classes, "*I've been doing quite a lot of pilates the last number of years because actually I was getting quite round shoulders and leaning forward, and I was trying to strengthen my back*" (Sarah)
b) habitual PA "*digging, cutting down rhododendrons and dragging big branches and em sort of conservation work yeah*" (Aoife) and
c) recreational exercise such as, '*swimming*' although both participants who reported engaging in this type of activity, recognised that it was not a bone mass augmenting form of exercise due to the weightlessness associated with it (as body weight is supported by the water).

Sedentary Behaviour

Many participants were aware that SB is not merely a '*couch potato*' syndrome, i.e. everyone participates in SB and it can be as simple as '*watching television*'.

"I think everybody probably does sedentary behaviour because you do have to rest, I mean resting is important" (Sarah)

Overall, participants described SB as '*unhealthy*' or '*not good for you*' and that it represents "*the length of time you spend sitting on any given day or your capacity for sitting down and not moving*" (Orla)

A '*standing desk*' was mentioned by three participants, which suggests their awareness around the effects sitting down at a computer for long periods of time has on the body. Similarly, two people mentioned how they are aware that SB is a social norm in modern society that it is hard to break a '*habit*' especially because "*It's the first thing you do when you go into someone's house you know come in and sit down but I'm trying to it's just what everybody does*" (Sandra)

Impact of Sedentary Behaviour

Several negative health consequences of being inactive were identified by the participants overall, impacting '*strength*', '*blood pressure*', '*breathing*', '*joints*' and '*mental health*'.

"the only way you can maintain bone health is by challenging it and by putting pressure on them and if you don't move that doesn't happen" (Mary)

"but also, other conditions like your breathing I mean your whole body is not awake overall its bad for your overall health including your bone health" (Eileen)

Motivators to Reduce or Sustain Sedentary Behaviour

Motivators to interrupt SB

Encouragement varied for participants; self-motivation was an important factor for those who *'live alone'* as *"there is no other person who would motivate me other than myself" (Eileen).* Whereas social influences such as *'phone calls'* or family often help break up sitting time for other people.

"I have got two grandchildren and if they get fed up or bored I think that if we touch our toes or we jump up or down or if we do something to break up the time particularly if they've got their homework to do they love doing exercise instead of their homework" (Sandra)

Some participants were reminded physically by the negative impacts of sitting such as feeling *'stiff'* or *'pain'* which motivated them to keep moving and stay active.

"I do have slight lower back problems…. if I've been moving constantly then everything's a lot more mobile but if I'm sitting for a long time then if I then stand up things aren't working as normal that's why I tend to move around a lot" (Orla)

Encouraged SB

There are several motivating factors, the most popular source of encouragement to remain seated was *'the television'* whether it be watching a *'programme'* or a *'film'*, while physical aspects such as *'pain'* would also be a factor encouraging them to sit down and rest for a while.

"if I'm sitting because of back pain probably eh maybe as little as 10 minutes" (Aoife)

Social norms have a way of encouraging SB in society such as *'an office environment'* or *'out for a coffee with friends'*.

"I had a job where I didn't have to be at a computer all day but I'm glad I didn't work at those kinds of jobs now. My daughter has to watch because she sits for long periods and she's aware of that" (Freya)

Age-related deterioration

The ageing process is associated with a deterioration in balance, strength, muscle mass and walking speed and participants were aware of the body's diminished physical capacity as they got older and they understood the importance of 'use it or lose it' which often provides them with the motivation to stay active.

"well at our age you lose muscle strength. I mean your heart is not working, just your body is not working if you are sitting still to the same extent if you are up and moving

around. And I mean I notice it if I have had two days where I have been in a good book where I have been sitting in the morning as well as in the evening... I can tell you my muscle tone is going you can feel it and that's the danger of being in hospital and you're not getting out of bed for up to 2 weeks you've lost a lot of your muscle strength" (Freya)

Older people and Technology

Reminder to Interrupt SB

There was a good representation of the sample population who were reminded to interrupt their inactive periods daily through technology.

"I wear the fitbit and you know it does that thing where if you don't do your 250 steps in an hour it gives you a little buzz" (Mary)

However, others highlighted that they preferred less invasive methods like an advert on television.

"even sort of thinking like getting up during an ad break but that depends on looking at a programme that has ad(vert) breaks" (Orla)

Through discussing possible intervention strategies with participants on how to remind people to break up their SB, a possible post COVID-19 collaboration between Scottish government and *a celebrity* to have exercise on TV for those who do not engage with technology could be helpful to raise awareness of the importance of staying active.

"take the advantage of getting used to the NHS reminding us about things just to keep it going after this pandemic is over" (Freya)

Use of Technology

Most participants appeared to be confident in using technology and enjoy the interaction, various modes included smartphone, laptops, iPad, Fitbit and apps.

"I've got lots of apps" (Rose)

However, two participants viewed the phone as a functional thing just to talk to people.

"I've got a smartphone but I've only got it so I can do facetime with my daughter but I'm not really interested in that stuff and I just use it as a phone" (Freya)

Barriers to technology

Participants freely stated some of the problems that they recognised with older people using technology to reduce SB.

Accessibility and usability of technology or internet connection (broadband) in general for the older generation was recognised as a potential obstacle.

"I think the age group you are talking about don't use computers, a lot of them do but there are a certain number that don't, don't have access to any broadband or internet and I think it's really hard" (Katherine)

"I mean everybody has got their DVD's and podcasts and the apps but a lot of older people don't have things like that" (Sarah)

In addition, the cost associated with the high standard technology that is on the market was identified as another barrier for the older generation who are retired and may not have a large disposable income.

"Not everyone could afford, I suppose I could buy a fitbit but they're very expensive" (Michelle)

Discussion

This exploratory qualitative study appears to be the first to look at the knowledge, views and experiences of SB in older women with OP and the findings could help guide future intervention development. The main themes found in this study include 'Older Women's Knowledge', 'Motivators to reduce or sustain SB' and 'Older Adults and Technology', each of these themes has further subthemes which encompassed the overarching theme.

Firstly, the theme 'Older Women's Knowledge' targeted three key areas PA, SB and the impact of SB. Participants reported a common change in exercise/PA patterns post-diagnosis, which included taking up weight-bearing exercise, as loading the bone or high impact movements provides a stimulus for bone formation. The mode of exercise among this group coincides with the recommendations to improve balance, bone density, strength, and flexibility to prevent falls and fractures[26]. In contrast, the ROS helpline conversations and 'A Good Life with Osteoporosis' report showed quite the opposite, over half of newly diagnosed osteoporosis suffers had reduced or given up activities after diagnosis[27]. This may suggest that participants in our study were highly motivated individuals who were biased towards higher levels of physical activity. However, there were varying abilities among the participants in this study which was displayed in their described PA levels for example, some were limited in their level of PA with back pain after a spinal fracture (which is an OP related effect) and others stated that they don't do as much as they used to (which is an effect of the natural ageing process). Avoiding forward bending or reaching up high around the house were stated as activities participants are more aware of and have either limited or ceased both in this particular study and in the literature reviewed[26,28].

This population subgroup appeared aware and up to date with knowledge surrounding SB and their disease while recognising that SB is an issue that should be addressed through initiatives to reduce SB among the OA population. While there is no literature covering OP sufferers understanding of SB, there is some evidence to point towards a lack of knowledge about the actual disease among newly diagnosed patients in the UK[29]. The participants in this current study appeared to understand the type of PA and its benefit to bone health, but not the frequency or intensity of PA they should be engaging in. This level of knowledge/

familiarisation with their disease could be related to the length of time since diagnosis (an average of 9.3 y in our study - Table 1) and thus, the information received from the health care system. Therefore, understanding SB could be directly linked with awareness of PA levels among members of society, particularly those who depend on PA in the management of their disease.

The impact of SB was overall perceived to have a negative effect holistically but perhaps more specifically on bone health for OP sufferers. Participants described the impact of SB in a way that was similar to other studies[20,30-32]. Participants highlighted that their peers or family tend to encourage/motivate them to be active, which was also found in other studies[30,31]. Although, Chastin et al. showed some conflicting evidence among older women who felt strongly encouraged to sit more and discouraged towards engaging in PA[32]. The negative effects of sitting on the body (e.g. soreness, stiffness, bad circulation), and activities of daily living (e.g. making tea, housework, using the bathroom), were identified as reminders to the individual to interrupt SB, which was also found by previous researchers[20,31,32]. Interestingly, participants understood that while you were sitting you are in fact '*sedentary*' regardless of the activity thus, you must stand up and move to break up the behaviour. This differs to the voices of older people in the Seniors USP study, where OA did not view themselves as being sedentary if they were '*busy*' while sitting[30].

Differences in the level of knowledge on SB between the general OA population and OA who suffer from OP, could be explained by the ongoing connection to the health services after the OP diagnosis. Newly diagnosed OP suffers are invited to attend health education talks and receive information, from the ROS, their General Practitioner and Fracture Liaison nurse, on PA which could help them maintain function and manage their disease after their diagnosis.

Within the theme 'motivation to reduce or sustain SB', there were no new findings that had not already been supported in previous literature such as, social influences, physical limitation (pain/stiffness) or maintaining habits[20,31]. Awareness of the amount of time they spend sitting appeared to be a big motivator for reducing SB and recognising the social norms/stigmas around sitting can help prevent prolonged periods of sitting and encourage their peers to go for a walk and a chat rather than sit inside.

Finally, the relationship between OA and technology; reminding people to interrupt periods of sitting could be a key factor in reducing overall SB, some suggestions included technology reminders, while another interesting method incorporated advert-breaks in television programming. Not all OA have reported their willingness to use technology in this context, indeed the opposite was found in previous SB reduction studies in which technology was described as problematic and inconvenient[31]. In our study however, almost all the participants reported owning a smartphone and/or another form of technology (e.g. laptop/tablet) which may

not be the case for many of their counterparts. A possible explanation could be linked to the SES of the participants in this study; 91% of participants were categorised in the least deprived category thus, eliminating one of the barriers to access technology. It is evident that there is no one-size-fits-all solution, some OA will comply with and embrace the advances in technology while others will not. Even in our predominately affluent subgroup, views about the use of technology were not unanimous and there were some who were not in favour of technological devices, which is in line with previous studies in OA (e.g.[31]).

Strengths and Limitations

This study is not without limitations, a semi-structured interview approach was adopted instead of focus groups due to COVID-19 social distancing disruptions. Interviews took place over a two-month period in which the self-isolation guidelines differed from the start to end. This may have influenced the individuals time spent doing structured exercise as well as activities of daily living such as shopping, meeting friends, minding grandchildren. Thus, the participants' views and experiences with SB may have been altered. We followed a semi-structured interview approach as these allow the participant flexibility to express their opinions, ideas, feelings and attitudes on a certain topic while providing the interviewer with a deeper knowledge than structured interviews could[33]. Telephone interviews were time-efficient, cost effective and provided physical safety for the researcher and participant however, they can result in the loss of non-verbal or contextual data[33]. Additionally, the study population convenience sample may have not been representative of the whole osteoporosis population as they appeared to be health-conscious people, recruited mainly from OP support groups, were of an affluent background and essentially a small sample size comprised of older women. It is known that communities of a lower SES (and/or higher crime rates) have been associated with a greater time spent sedentary in the OA population[34].

To the best of our knowledge this is the first study to explore the knowledge of SB among people with OP, the findings from this study could help identify opportunities for interventions to reduce SB and help those with the diagnosis to maintain good physical activity behaviours. It would be important to conduct interviews with OP from lower SES to overcome the affluence selection bias.

Conclusion

Knowledge does not appear to be a factor that needs addressing in relation to SB in older women diagnosed with osteoporosis. The motivators (i.e. social interaction/influences) and barriers (i.e. help with technology) could help older adults recognise or become more aware of their SB patterns. This study should be replicated in a wider sociodemographic population to explore the influence of affluence.

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